# Digital Diversity in Software Development Companies: Is It for Real?

*Completed Research Paper*

**Shahla Ghobadi**
University of New South Wales
Sydney, Australia
s.ghobadi@unsw.edu.au

## Abstract

*This study introduces the concept of 'digital diversity' to refer to the increasing workforce heterogeneity that stems from the recent rise of digital natives in the workforce. While digital diversity is expected to promise innovation and efficiency, it may also give rise to organizational challenges. The nature of the promise and challenge of digital diversity as well as how it is perceived across diverse groups, however, remain unexplored. Through a multisite study of software development companies, this study provides a deeper understanding of digital diversity and its promise and challenge in the particular context of software development workforce. Furthermore, drawn upon empirical data and insights from generational and diversity research, a model distinctly suited to studying digital diversity in software development workforce, is developed. Contributions to theory and implications for software development companies are discussed and new avenues for future research are outlined.*

**Keywords:** digital natives, digital immigrants, diversity, digital diversity, software development, software teams, software industry, software companies, IT workforce, IT human resource

## Introduction

The ever-increasing diversity of societies and organizations has seen an evolution of organizational employees that are argued to be distinctly different from previous generations (Alsop 2008; Hendricks and Cope 2012). This new generation, named as digital natives, has grown up in a world where the use of information and communication technologies (ICT), for both personal and professional purposes, is pervasive, whereas the other generation, digital immigrants, has learnt to engage with ICT during adult years (Prensky 2001; Prensky 2009; Rogers 2001). Although many digital immigrants have become skilled users of technology, research suggests that their purpose, preference, and patterns for using technology may differ from their digital native counterparts (Vodanovich et al. 2010). For example, whereas digital immigrants are frequently seen to be users of ICT, digital natives tend to take more active roles in creating online contents (Leung 2013; Sharp 2000), or while digital immigrants seem to favor phone call or email for online communication, digital natives prefer using texting and more synchronous forms of instant messaging (Storm 2011; Vodanovich et al. 2010).

However, in an age that increasingly demands innovation, agility, and nimbleness, serious challenges may arise when digital natives, with new attitudes, cognitive styles, and work characteristics, enter the workforce (Alsop 2008; Kelan 2009). Digital natives tend to prefer informal and participatory systems rather traditionally solid organizational tools, question unidirectional flow of organizational knowledge, and value instant recognition of ideas and proposals. Therefore, as new opportunities open up for digital natives in the workforce, a new reality presents itself: the promising rise of this new generation into organizational contexts may be also very challenging (Smola and Sutton 2002; Twenge et al. 2010). As a result, creating balanced working environments, which adapt to the needs of this new generation of workers without excluding the concerns of digital immigrants, is capturing the attention of contemporary

organizations (Puybaraud and Hannah 2012; Srinivasan 2012). A careful recognition of the promise and challenge of the rise of digital natives in the workforce is a critical prerequisite for creating balanced environments and addressing potential intergenerational difficulties within the workforce.

While some prior studies have examined some of the implications of the rise of digital natives in education and learning contexts (Jones et al. 2010; Waycott et al. 2010), it is only recently that the concept of digital natives has gained the attention of information systems (IS) researchers. In addition, although some IS scholars emphasize the importance of research on the rise of digital natives (Vodanovich et al. 2010), there is limited understanding surrounding the promise and challenge of the rise of digital natives in the workforce. Furthermore, recent studies in education and learning systems, the discipline within which the concept of digital natives has reached a higher level of maturity, have highlighted lack of rigor and cohesion in the manner in which the digital native concept is studied and used (Bennett et al. 2008; Helsper and Eynon 2010).

Taken together, given the very recent widespread rise of digital natives and consequently digital diversity in the workforce (workforce heterogeneity in terms of being grown up in different digital worlds), it is important to investigate digital diversity and clarify its promise and challenge. This investigation is important to inform us about strategic decisions that companies may devise in order to take concerns of different generations into account and assist in bridging communication gap between them. This is particularly important in homogeneous yet controversial contexts, such as software development companies, that although largely governed by the body of digital immigrants, increasingly require and attract tech-savvy digital natives (Zweben 2011) to ensure the needs of the modern generation of end users are reflected in software products (Krill 2011).

The objective of this study, then, is to contribute toward this goal, specifically by exploring digital diversity and identifying its promise and challenge in software companies. Through the guidance of the following research questions *(does digital diversity exist in software development workforce? And what are the promise and challenge of digital diversity in software development workforce?)*, research on generations and work-group diversity (Van Knippenberg et al. 2004; van Knippenberg and van Ginkel 2010a) is applied to explain empirical evidence from an intensive multisite study of three software companies. Despite certain conceptual, organizational, and process challenges, the findings indicate valuable opportunities in the rise of digital natives that, if addressed with care and forethought, can reinforce organizational learning and promote a culture of optimism and flexibility in software development work settings. The data also sheds lights on some key mechanisms through which digital diversity can produce work-related outcomes. The key contributions of the paper are introducing and shedding light on the phenomenon of digital diversity in software development workforce, and elucidating some of the mechanisms through which it can produce work-related outcomes. The rest of the paper is organized as follows. First, a brief review of research on digital natives and work-related diversity is provided, followed by a discussion of the research methodology. The model that emerged from empirical data and insights from the extant literature is then elaborated. Finally, the findings are discussed and the key contributions to research and practice are outlined.

## A Review of Literature on Digital Natives

The concept of 'digital natives', or 'net generation', has roots in education and learning commentaries (Barlow 1996), and was initially introduced by Tapscott (1998) and popularized by Prensky (2001) to refer to the new generation of students who have grown up with digital technology as an integral part of everyday life, in contrast to previous generations, termed as 'digital immigrants', who have learned to use and leverage technology during their adulthood years. Following the work of Prensky, research, mostly in learning and education arena, has attempted to explore how this generation of young students is different from their instructors and educators in terms of working with and using ICT (Gui and Argentin 2011; Guo et al. 2008; Helsper and Eynon 2010; Jones et al. 2010; Livingstone 2010; Margaryan et al. 2011; Ng 2012; Qureshi 2006). Possible differences (e.g., preference to have nonlinear access to information) (Hayles 2007; Small and Vorgan 2009) are linked to diverse thinking systems that have stemmed from growing up in different digital cultures (Vodanovich et al. 2010). Different thought and mind processes between individuals are shown to affect performance in collaborative contexts (Aggarwal and Woolley 2013; Kang et al. 2006). For example, Aggarwal and Wolley (2013) examined how team's composition in terms of individuals' cognitive styles (spatial visualization versus object visualization) affects team's

strategic consensus. Individuals high in object visualization encode and process images holistically, whereas individuals high in spatial visualization generate and process data analytically (Kozhevnikov 2007). Their result showed that heterogeneity in cognitive style inhibits the formation of strategic consensus and in turn increases the occurrence of committed errors (Aggarwal and Woolley 2013).

Within the IS discipline, calls for research on the rise of digital natives and its implication for IS research are being recently propounded (Fitzgerald and Stol 2014; Qureshi 2006; Tilvawala et al. 2013; Vodanovich et al. 2010). For example, Vodanovich et al. (2010) painted a promising research agenda, which invites further examination on understanding the diverse technological, social, and managerial issues arising from the use of ubiquitous information systems. Although emerging studies target issues related to the interaction between digital natives and ubiquitous information systems *(*e.g., how ubiquitous information systems should be designed for the new generation of users*)*, research on the very recent rise of digital natives in the workforce along with its promise and challenge is unsettled and not yet emerged. IT-related work environments, such as software development companies, that increasingly attract the generation of young tech-savvy employees, are particularly important areas that need further examination.

Furthermore, although research on digital natives draws on tenets of generations based on western economies (e.g., Veterans, Baby Boomers, Generation X, and Generation Y/Millennials) to account for differences between digital natives and digital immigrants (D'Amato and Herzfeldt 2008), scholars warn that *digital nativeness* is a flexible rather than a determinist concept, and due to several personal and environmental reasons a person may exhibit characteristics of other generation (e.g., digital immigrant) rather than fully falling into one generational category (Helsper and Eynon 2010). In addition, recent empirical studies indicate that only a small subset of the population fits the definition of digital natives (Helsper and Eynon 2010; Margaryan et al. 2011), and that there is within-population variations and differences in the technology use, skills, knowledge and interests of these young people, which may be more significant than between them and the so-called digital immigrants (Bennett et al. 2008). Supporting these lines, digital divide literature advises us that several factors such as affordability, motivation in using ICT, and social regulations and policies can easily cause differences among people in terms of their access to and use of ICT (Rice and Katz 2003; Van Dijk and Hacker 2003; Van Dijk 2006; Wei et al. 2011). A major theme that emerges from review of the literature is that most of the studies tend to adopt a fixed age-based definition of digital natives (e.g., born after 1983) without putting this definition into context to examine whether the studied young individuals have grown up with ICT to be natives of the digital world.

On similar lines, the recent approaches to generations suggest that generations are more complex, context-dependent and multidimensional to be studied solely based on single factors such as age or ethnic background (Gilleard and Higgs 2005; Hansen and Leuty 2012; Twenge 2010). For example, while research taking a cohort-based view to generations argues that membership in a cohort (e.g., age group) can contribute to shared identity and that cohort differences can nurture conflict at different levels (Lawrence and Zyphur 2011; Smola and Sutton 2002), this line of research has received criticism to use arbitrary cohorts and generations (e.g., Millennials) as fixed age-based groups (e.g., young adults who were born after 1982) interchangeably (Egri and Ralston 2004; Smola and Sutton 2002), and that this has generated difficulty distinguishing whether a particular generational difference is a matter of age, education, life-stage, or historical event (Joshi et al. 2011b; Srinivasan 2012).

Taken together, we can argue that existing research on digital natives, in particular in the IS discipline, demonstrates little critical scrutiny, is under-theorized, and lacks a sound empirical investigation that is based on robust operationalization of the concept of digital natives. These limitations are expected to be an important inhibitor in uncovering a better understanding of differences between digital natives and digital immigrants, and thus in realizing the promise and challenge of digital diversity in work-related settings. To contribute new empirical and theoretical insights into the outlined research objectives, the first step of this study involves selecting a theoretical foundation to guide the empirical inquiry, and then as a second step, the promise and challenge of digital diversity in the software development workforce are identified, and finally, empirical evidence with theoretical insights are combined to establish a theoretical model of digital diversity in such settings.

## Theoretical Foundation

*'Generation'* is a rich and alive concept that has remained the subject of popular media and academic studies for years (Biggs 2007; Burnett 2010; Joshi et al. 2011a). It expresses both the passage of time as well as the boundary makers of what we can understand about 'kinds of people' who lived in 'kinds of time' (Burnett 2010). The early origins of research on generational difference is traced back to the work of Karl Mannheim (Mannheim 1952), who emphasized the importance of studying generations as a guide to understanding the structure of social and intellectual movements. Intergenerational interactions are believed to provide a fertile ground for transmitting skills, knowledge, experiences and resources that generations have developed. However, the successful transfer of resources across generations is not easy and a wide range of relationships is likely to occur. Intergenerational interactions can range from resistive to transmitive interactions. At the resistive end, they may exhibit attitudes such as mistrust, competition over scarce resources and bias, and behaviors such as conflict and competition, and at the transmitive end, they may exhibit attitudes such as trust, empathy and mutual respect, and behaviors such as reciprocity, altruism and beneficence with respect to the knowledge, skills, and resources unique to each generation (Joshi et al. 2010).

The increasing generational diversity among today's workforce has led to debate on its promise and challenge (Lester et al. 2012; Shewchuk et al. 2009). The optimistic view has roots in studies that highlight advantages of heterogeneous groups versus homogenous ones (Hoffman 1959) and holds that generational diversity increases the variety of perspectives, vigorous debate, opportunities for synergistic knowledge sharing, and capacity for creative problem solving (Harvey 2012; Marcinkus Murphy 2012). The pessimistic view argues that generational diversity can exacerbate social divisions and thus hinders communication and intensifies conflict (Yu and Cable 2011). These two views concur with the research taking 'information sharing' and 'social categorization' perspectives in studying organizational diversity (Roberson 2012; van Knippenberg and van Ginkel 2010b). The categorization-elaboration framework (Van Knippenberg et al. 2004), with its roots in diversity research (Mannix and Neale 2005), is based on the integration of information sharing and social categorization views to identify the processes underlying the positive and negative effects of work group diversity.

First, the framework asserts that the effects of diversity on group performance (e.g., innovation, decision quality and cooperation) are realized by elaboration of task-relevant information and perspectives, which refers to the exchange, discussion and integration of task-related information and perspectives. Along similar lines, software development research concurs with this view, arguing that homogenous teams, with a small degree of experience spread, are less likely to look beyond their immediate boundaries for help in problem-solving processes, and thus they exhibit less visionary behaviors (Guinan et a., 1998). Second, diversity may be disruptive to elaboration and therefore to performance when it generates intergroup biases. Specifically, social categorization, as induced by digital diversity, may be perceived as a threat to group's identity and status, and in turn generate intergroup biases that often manifest in relationship conflict. Intergroup biases (e.g., favouring in-group over out-group relations) can lead people to see in-group members as more valid sources of information. Therefore, communications from in-group members are more likely to influence the thoughts and actions of individuals. Such biases inhibits attention to information from diverse groups and can interfere with diversity's promising potential (Mitchell et al. 2011). Finally, the framework argues that the relationship between diversity and elaboration of task-relevant information and perspectives, either positive or negative, can be moderated by task-related requirements. More specifically, diversity may engender elaboration of information and be positively related to performance (i) when performance requires creative and innovative solutions and (ii) when individuals' task motivation and task ability in sharing information is high rather than low.

The categorization-elaboration framework focuses on collaborative settings, and prior research has supported its approach for studying the double-edge impact of diversity on performance (Cunningham 2011; Gonzalez 2012; Kearney and Gebert 2009; Mitchell et al. 2011; Seong et al. 2012; van Knippenberg and van Ginkel 2010b; Yang and Konrad 2011; Yu and Cable 2011). Integrating 'information sharing' and 'social categorization' perspectives, this framework enables studying the promise and challenge of digital diversity simultaneously. It can be, therefore, instrumental in understanding digital diversity and explaining its promise and challenge in the collaborative context of software development. The following sections outline the empirical case.

## Research Methodology

## *Data Collection*

Three medium-size software companies, which are referred to as Alphas, Beta, and Delta (as pseudonym) were studied. These companies are appropriate representatives of the phenomenon under investigation, that is, the increasing rise of digital natives in software development work environment; they are increasingly recruiting the new generation of software engineering students and graduates for their software development projects. They also represent critical cases in terms of the quality/reputation of the organization (Sarker and Sarker 2009). While Beta and Delta are acknowledged as leading commercial companies in building and implementing financial software and collaborative technologies, respectively, Alpha is widely appreciated for its open source software development, with a recent profile of commercial projects.

The development manager of each company provided entry for conducting fieldwork and helped identify and recruit potential interviewees, thus enabled immediate legitimacy and credibility to the research study (Patton 1990). Together with each development manager, two groups of professionals were selected, one group to be associated with digital natives and one group to represent digital immigrants. Finalizing an initial list of potential interviewees in each company, an official email from each development manager, introducing the research project and the interviewer, was sent to the relevant staff.

Following the formal introduction, each individual was contacted and asked about his/her prior exposure to ICT, in particular personal computers and the Internet. Questions such as the following were asked: *"When was the first time you started using personal computer and the Internet, and how old you were at the time?" "How was your first experience using the Internet?"* The criterion for being considered as a digital native was 'a regular use of both personal computer and the Internet from, at least, the age of 12, which is reported to be the marker of biological adulthood (Rescher 1987)'. This careful criterion helped delve inside participants' real world experience with technology and stay away from the common misleading jargon that associate being digital native with common fixed age-related factors such as the birth year (e.g., born after 1983) (Helsper and Eynon 2010; Margaryan et al. 2011). In choosing the interviewees, we chose natives and immigrants in a way that they do not belong to very different age groups (the average age of natives is 21 years old and the average age for immigrants is 36 years old). Since we were interested to explore differences between natives and immigrants in terms of being grown up in different digital worlds, this helped in controlling age-related differences between natives and immigrants.

After finalizing the list of participants, formal in-depth interview sessions, which were taped and transcribed, were conducted (typically lasting between 45 minutes and an hour). Over a period of approximately one year (December 2012-Feb 2014), thirty-eight formal interviews were conducted. Table 1 presents the brief demographics of the sample.

**Table 1. Sample Demographics**

| Group | | Company Alpha (14 interviewees) | Company Beta (11 interviewees) | Company Delta (13 interviewees) |
|---|---|---|---|---|
| Digital Natives | Number | 5 | 4 | 5 |
| | Age (mean) | 21 years | 22 years | 23 years |
| | Role | tester, developer, user interface designer | | |
| | Job status | Full time: 90%<br>Part time: 10% | Full time: 85%<br>Part time: 15% | Full time: 80%<br>Part time: 20% |
| Digital Immigrants | Number | 9 | 7 | 8 |
| | Age (mean) | 36 years | 33 years | 35 years |
| | Role | Senior developer/ tester, developer, project manager, product owner, infrastructure designer, user interface designer, business analyst | | |
| | Job status | Full time: 100% | | |

Respondents were asked about their opinion and observations regarding the differences between digital natives and digital immigrants at work, and the implications of such digital diversity in their workplace. A flexible, open, and nondirective style of conversation was followed, and the emerging interview questions varied depending on the interviewee's motivation and ability to elaborate on the subject. This allowed

evoking new concepts, and, creating multiple occasions for access to human memory (Laukkanen 1994). When interviewees revealed opposing views about the implications of digital diversity, further in-depth investigation, such as a follow up informal interview, was undertaken to explore differing perspectives and arrive at a richer understanding (Flick 2014). The number of the required interviews is considered as a judgment call by researchers, because point of redundancy, which calculates the adequacy of the sample, is not known until initial stages of data analysis are completed (Nelson et al. 2000). Data analysis showed that the concepts (e.g., promise, challenge items) were exhausted by the time we reached 'respondent 27' (no new concept emerged after 27 interviews), validating the judgment to stop interviews after 38 individuals.

### *Data Analysis*

To address the research questions *(does digital diversity exist in software development workforce? what are the promise and challenge of digital diversity in software development workforce?),* data was analyzed in four steps. First, researcher read all the transcripts, grouped frequently mentioned words together, and inductively generated a list of preliminary codes to explore digital diversity and its promise and challenge in the examined context. Each code was presented by a label that summarized the meaning of a number of words or phrases used by the interviewees. To provide a basis that explains how diversity generates outcome (promise and challenge), the coding scheme was examined against the theoretical framework (information sharing and social categorization mechanisms and the moderating task-related factors), without necessarily expecting the evoked concepts and relationships to fully reflect the framework. A research assistant read the material to verify their face validity and assess the parsimony and coverage of the coding scheme.

Second, a researcher coded all transcripts and another helped by reading the material to verify the validity of the coding. Where disagreement occurred, discrepancies were resolved through discussion to minimize researcher biases. To estimate the reliability of the coding process, Scott's pi (Scott 1955) was calculated using 10 of the interview sessions. Scott's pi for the study was estimated at an acceptable level of 0.88 (Holsti 1969). These processes resulted in identifying some characteristics of digital diversity and the promise and challenge that stem from them. The promise and challenge items were then grouped into relevant categories (e.g., organizational learning, innovation, different real-world experiences). Third, the table was reviewed to make sure all the items are the result of growing up in different digital cultures. For example, it was noted that a promise related to the rise of natives in the workforce is 'balancing salary packaging' (because natives are often younger and they have lower salary offers and expectations compared to senior developers); such general items were removed to make sure the items are specific to digital diversity; this resulted in seven promise and eleven specific challenge items (Table 2).

Fourth, the results' validity, applicability, and comprehensiveness were examined by presenting them to sixteen software professionals over a focus group session. Participants were asked to make sense of and apply the findings to their observations and to provide feedback and suggestions on its application, strengths, and areas for improvement. Overall the participants found the findings comprehensive and useful to understand the opportunities and challenges in introducing digital natives in software development work settings, though the findings was refined based on minor suggestions (e.g., rewording challenge areas). As a result, seven promise and eleven specific challenge items that stem from digital diversity or are particularly pronounced due to being grown up in different digital worlds were finalized (each item is discussed in the Results section). For example, (i) 'natives' insufficient skills and lack of interest in collaborating on code' was noted to be the result of independent coding for years, or, (ii) different product and process expectations were argued to be the result of working with technology from early years and seeing human-computer interaction in a more intuitive manner. Finally, the analysis of data regarding the promise and challenge of digital diversity shed light on some key mechanisms through which digital diversity can produce work-related outcomes, which were summarized and depicted in Figure 1.

## Results

## *Digital Diversity, Promise and Challenges*

The interview statements from 38 professionals across companies Alpha, Beta and Delta suggested unique characteristics of digital diversity in software development that stem from growing up in different digital worlds and also early exposure to programming. Analysis of empirical statements also indicates how these characteristics give rise to seven promise and eleven challenges in the examined context, as shown in Table 2.

**Table 2. Promise and Challenge of Digital diversity in Software Companies**

| Promise | Challenge |
|---|---|
| **1.Organizational Learning** | **1. Conceptual Challenges** |
| **Learning from diverse software development experience** | **Native's preference to continuously adopt new technologies (compared to immigrants)** |
| *Learning from diverse thinking approaches* | *Natives' limited understanding of the core concepts of computer science* |
| *Learning through diverse familiarity with different technologies* | Natives' insufficient skills and lack of interest in collaborating on code |
| | *Natives' overemphasis on creating 'cool' software* |
| **2.Innovation** | **2.Organizational Challenges** |
| *Innovation through new product expectations* | *Native's overemphasis on taking development risks* |
| *Innovation through new procedural expectation* | *Natives' insufficient understanding of organizational politics* |
| | *Natives' immature way of dealing with clients* |
| **3.Productivity** | *Natives' preference for quick job turn over* |
| | *Increasing work expectations for digital immigrants* |
| *Increased work-related nimbleness* | **3. Process Challenges** |
| *Increased motivation and energy at work* | **Difficulties in making human resource procedures suitable for natives** |
| | *Natives' overemphasis on instant feedback and gratification* |

**Bold**= Both groups mentioned, Normal= Natives mentioned, *Italic*= Immigrants mentioned

For examples, interviewees referred to different real-work experiences between natives and immigrants that stem from starting programming from different ages (e.g., natives noted that they have started programming in their early teenage years, prior to attending formal computer science education). As a result, the time gap between coding and formal engagement in client-based software development was considerably more in natives compared to immigrants. Both natives and immigrants argued that this characteristic has made natives to be primarily focused on producing code rather than dealing with formal software development processes, organizational politics, and client-based interactions (linked to the challenges of 'natives' immature way of dealing with clients', 'natives' insufficient understanding of organizational politics'). An interviewee, representing digital natives, pointed out: *"Most of us are confident in our programming skills. But our experience is limited to working on smaller projects, and of course, dealing with less difficult clients"*, although the same interviewee continued: *"Having the opportunity to discuss various aspects of the project and learn from senior colleagues are really helpful"*. Despite such learning opportunities (referring to the promise of 'learning from diverse software development experience') that were noted to occur through effective information sharing between natives and immigrants (supporting the theoretical framework), different real-work experiences brought some other challenges as well. For example, natives highlighted that, although coming to software development at a young age is useful in making them open to trying new technologies, independent coding has made them relatively disorganized and uncomfortable to work in structured and collaborative software development work contexts (referring to the challenge of 'natives' insufficient skills and lack of interest in collaborating on code'). Said a developer *"I'm a socialish [with an ironic tone] person but I am not used to be that social when it comes to collaborating on code"*. Immigrants' experience in dealing with client

was also proved to make them busy with product ownership activities, inhibiting them from sharing their experience and perspectives with the younger generation.

They also argued digital diversity can stem from different project focus areas between natives and immigrants. For example, while immigrants, due to a less time gap between learning programming and dealing with client, were committed to meet project deadlines and stay within the budget, natives were keen to cross bureaucracies of software development and advocate for taking development risks. A developer, representing digital native group, claimed: *"We have come to a meeting to discuss certain aspects of a project... But we have gradually diverged into groups with different tastes favoring different approaches. I'd say [immigrants] were more focused on planning to meet project requirements whereas we wanted to take more development risks."* While many of immigrants argued that sharing their ideas and attitudes increase organizational agility, infuse motivation and energy across organization (referring to promise of 'increased work-related nimbleness' and 'increased motivation and energy at work'), they also believed these reflect natives' limited experience in dealing with clients and familiarity with software development risks (related to the challenge of 'natives' immature way of dealing with clients'); said a senior tester: "*We follow agile principles .. But it doesn't make us stay open to new additions until the last minute... I feel the new developers are more open to go for such risks... Perhaps because they have previously worked on smaller and often not formal projects, and they have turned out to be okay*."

In another example, interviewees referred to different mindsets between natives and immigrants. Overall, immigrants agreed natives' strong immersion in technology from early years has influenced them in a way that they approach software development differently, and that differences between natives and immigrants enable cross learning from diverse thinking approaches. As indicated by one of digital immigrants: "*I think having this generation on board has generated ideas and new debate about processes and products. We have designed lean and more intuitive processes around end user experience."* Besides, immigrants believed that early coding without being familiar with the fundamental concepts of computer science brings fundamental challenges. For example, one of the interviewees representing digital immigrants' population stated: "*I found that the new batch of developers is not quite concerned with the core concepts of software development and the underlying components that make technology and networks work. Instead they expect quick and easy solutions by mixing plugins, frameworks, and bits of codes. This can lead to a system that it's difficult to customize, and hardly portable and scalable enough to handle large numbers of users*."

Interviewees also referred to different product expectations between natives and immigrants. In particular, digital immigrants specified how natives, due to being grown up with technology and working with it in an intuitive manner from early years, contribute new approaches and expectations in design and development of products. As indicated by one of the digital immigrants: "*Innovation is critical to our product releases. Having them [natives] has brought new expectations about how the final software should look like. We have approached more creative and intuitive solutions*." However, immigrants also alerted that native's overemphasis on developing 'cool' software can be problematic in a number of ways. For example, they may neglect fundamental software portability, scalability, and security requirements in software design, or they may get disappointed from the experience of working in structured software development work settings, and frequent work changes can give rise to a culture of turnover in these settings.

Finally, most of the natives suggested that there are inherent differences between natives and immigrants in terms of their willingness and flexibility to try new software development technologies rather than being used to their most reliable ones. "*It is almost unlikely to change someone who is not used to be flexible to new approaches and willing to look things up, challenge the status quo and try new things,"* said a developer representing digital natives group. Such perceptions showed to inhibit information sharing and task conflict between natives and immigrants. For example the same interviewee continued: "*Doing what you are told to do works sometimes. It is just that sometimes debate is too much of a headache."* Immigrants agreed with natives in their different levels of flexibility, and they considered natives' energy and flexibility instrumental for increasing nimbleness and motivation at work. Besides, they argued that software development needs some levels of control and accountability.

Overall, natives appreciated learning opportunities from diverse software development experience of immigrants; however, they emphasized challenges with regard to flexibility and adaptability (e.g., immigrants were not as flexible as natives in adopting new technologies, immigrants were not into taking development risks as much as natives were). Natives also acknowledged collaboration challenges that arise because of the history of independent coding from early years ('Natives' insufficient skills and lack of interest in collaborating on code'). Immigrants appreciated the fresh breath of innovation, agility, and organizational learning that come with the rise of digital natives; however, they were also concerned with certain challenges. For example, they highlighted natives' insufficient experience with software development politics and dealing with client (organizational challenges), natives' overemphasis on developing 'cool' software besides lack of deep understanding regarding the fundamental aspects of computer science (conceptual challenges), and natives' demand for instant feedback and gratification (process challenges).

# A Conceptual Model

Besides addressing the research questions, interviewees' statements regarding the promise and challenge of digital diversity draw attention into some key mechanisms through which digital diversity can produce work-related outcomes. These mechanisms are depicted in Figure 1, which centers around five constructs of: digital diversity, digital diversity promise, digital diversity challenges, elaboration of task related information and perspectives, and task-related moderators.

In summary: (i) *digital diversity* refers to workforce heterogeneity in terms of being grown up in different digital worlds, (ii) *digital diversity promise* refers to the potential positive consequences of digital diversity (as recognized in this study, it includes three categories of organizational learning, innovation, and productivity), (iii) *digital diversity challenges* refer to the potential challenges that may stem from digital diversity (e.g., conceptual challenges, organizational challenges, process challenges), and in turn have negative impacts (iii) elaboration of task related information and perspective refers to the exchange, discussion and integration of task-related information and perspectives, and (iv) task-related moderators refer to moderating factors that may influence on the way digital diversity generates promise and/or challenges: task *informational and decision requirements* refer to the extent to which the task is contingent on in-depth understanding of the issues at hand, creative and innovative decisions and superior products, *task motivation and task ability* refer to, the extent to which individuals are motivated to share and utilize their information, and the extent to which individuals are capable to share and utilize information, respectively.

As shown in Figure 1, the empirical data suggested that the promise of digital diversity (e.g., organizational learning, innovation) is realized through elaboration of information and perspectives across natives and immigrants (supporting the categorization-elaboration model). It has been widely known that software products continuously emerge from dense and iterative development and quality assurance cycles that require knowledge sharing in the form of rapid reflections and frequent feedback from team members (Ghobadi and D'Ambra 2013; Mathiassen et al. 2007; Oshri et al. 2008). Where digital diversity exists, establishing effective information sharing is not only necessary to bridge various skills, perceptions and mental models but also very helpful in enabling team members and stakeholders to exploit available resources and explore emerging opportunities in software design and development.

Unlike the categorization-elaboration model, overall, interviewees did not highlight social categorization and intergroup biases simply because of being a native or immigrant between natives and immigrants. Instead, challenges (e.g., conceptual, organizational, process challenges) were linked to inherent differences between natives and immigrants in their exposure to technology or using technology. Therefore, Figure 1 shows the direct link between digital diversity and challenge categories.

Interviewees across all the three companies confirmed that multifaceted tasks such as design and requirement specification invite more information sharing (Mathiassen et al. 2007; Vessey and Conger 1994), compared to intensive coding tasks such as solo programming (Dawande et al. 2008). For example, phases such as requirement elicitation and software design were argued to benefit from discussing different perspectives and ideas of digital natives and immigrants, more than routine coding and quality assurance activities. Therefore, the positive consequences of digital diversity (promise) can be more when the task requires and benefits from information processing, creative and innovative idea generation and

problem solving, and the negative consequences of digital diversity (challenge) can be more when the task does not require such characteristics. In addition, interviewees stated that motivated and capable teams engage in deeper information processing and reach better quality decisions (promise of digital diversity), whereas less motivated and capable teams were more inclined toward manifesting the challenges of digital diversity.

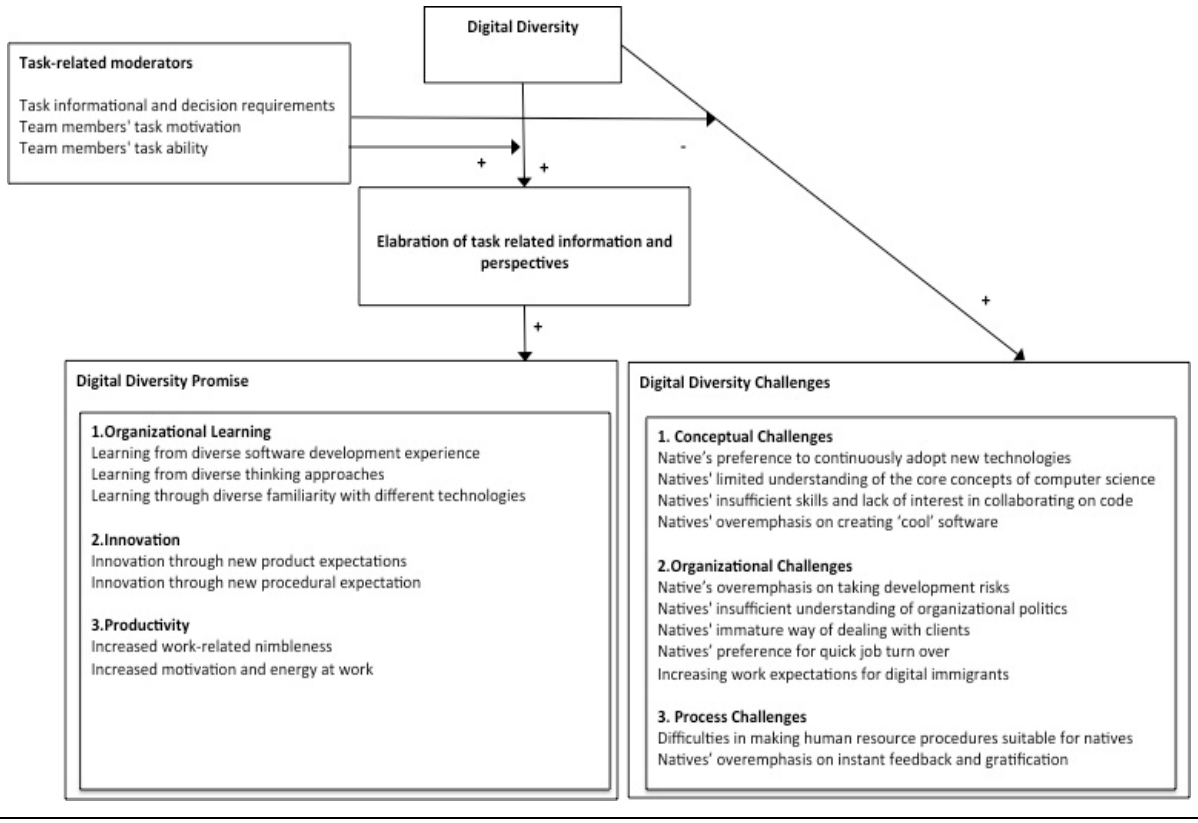


**Figure 1. Digital Diversity Model in Software Development**

For example, referring to task motivation, the development manager in Delta noted: "*We don't put pressure on developers to think and act the same, but we have tried to create a team of people who are extremely passionate about building well-made software. We care about making a large number of innovative and useful products.. This vision binds us together"* or, an interviewee representing digital natives echoed his viewpoint regarding information sharing ability as: *"It is easy to lose focus when working in a team of developers coming from all sorts of backgrounds. Pushing ideas forwards and communicating them well can definitely help."*

## Discussion

This study investigated the experiences associated with digital diversity in three software companies, identifying the core promise and challenge of this phenomenon in contemporary software development workforce and some mechanisms through which it affect work-related performance. Below, the specific research and practical contributions are highlighted and discussed.

**Recognizing that digital diversity in the relatively homogenous and tech-savvy work environment of software development companies exists, and it is more than a 'moral panic'.** As mentioned in the introduction and literature review sections, limitations in operationalizing the concept of digital nativeness (e.g., age-based measures) contribute to mixed results and difficulty distinguishing whether a particular generational difference is a matter of age, education, life-stage, or

historical event (Joshi et al. 2011b; Srinivasan 2012). In addition, the very broad and heterogeneous contexts in which digital natives have been compared with digital immigrants (e.g., classrooms) (Bennett et al. 2008) inhibit a controlled and careful examination, and therefore, within-population variations may seem to exceed cross-population variations. The existing limitations have resulted in an emerging literature questioning the inherit differences between natives and immigrants and calling for further in-depth investigations (Helsper and Eynon 2010). Furthermore, emerging studies on digital diversity is limited to studying this phenomenon in classrooms and education systems (Gui and Argentin 2011; Jones et al. 2010; Margaryan et al. 2011; Ng 2012; Prensky 2009) and more recently to investigating the interaction between digital natives and ubiquitous information systems (Fitzgerald 2012; Fitzgerald and Stol 2014; Tilvawala et al. 2013; Vodanovich et al. 2010). While the first generation of digital natives is graduating from higher education and entering the professional working world (Puybaraud and Hannah 2012), research on the implications of this very recent yet increasing phenomenon remains unstudied and unsettled.

Considering the discussed contextual (e.g., limited to classrooms) and definitional (e.g., age-based definition for digital natives) limitations in the extant literature, it can be argued that, if studied correctly, digital natives may exhibit new ways of approaching daily work and communicating with and integrating technology into their lives, which need to be uncovered. Within this context, high-technology environments, such as software development, are particularly important and interesting areas that need further examination. For example, digital diversity may be paradoxical for software development contexts in which tech-savvy professionals, regardless of fitting the categories of growing up with ICT (digital native) or learning to engage with ICT in adult years (digital immigrant), work. In addition, although largely governed by the body of digital immigrants, software development companies increasingly require and attract tech-savvy digital natives to ensure the needs of the modern generation of end users are reflected in their products.

As the digital natives' generation grows in software development companies, managers and human resources professionals will need to develop new strategies and engagement models that take differences between digital divides and digital immigrants into account and utilize talent and potential of digital natives into software development. The organizational outcomes of generational diversity are, however, formed by the nature of intergenerational contact and transfer between generations (Joshi et al. 2011b). Therefore, an in-depth understanding of how these generations can come together to form and influence software development efforts is critical. Despite a rich tradition of scholarship across many disciplines (*e.g.,* (Biggs 2007; Egri and Ralston 2004; Mannheim 1952; Smola and Sutton 2002)), information systems research on the topic of generations in organizations has been scarce. Focused on the context of digital diversity, IS literature demonstrates limited (if any) direction and guidance for understanding the increasing rise of digital natives in the workforce.

Articulating two research questions *(does digital diversity exist in software development workforce? And what are the promise and challenge of digital diversity in software development workforce?)*, this study drew on the past literature (*e.g.,* (Gui and Argentin 2011; Van Knippenberg et al. 2004; Vodanovich et al. 2010)) and carefully selected and identified a relatively homogeneous population of digital natives and digital immigrants across three software companies. Specifically, special care was paid into choosing interviewees and into making sure the findings are related to digital diversity (being grown up in different digital worlds), not other age-related or experience-related factors. For this, first a careful definition of digital nativeness was followed ('a regular use of both personal computer and the Internet from, at least, the age of 12, which is reported to be the marker of biological adulthood (Rescher 1987)'; discussed in the Data Collection section). Second, the selected digital immigrants were relatively close to digital natives in terms of their age (average: 36/21 years old) to control some differences in experience and age. Third, the findings were reviewed to make sure all the items are the result of growing up in different digital cultures (discussed in Data Analysis section).

Addressing the first research question, the analysis of data revealed inherent differences, although bridgeable, between the generation of digital natives and digital immigrants' software development workforce (e.g., Different work and process expectations, different opinion and thinking approaches). Overall, the nature of the differences seems to be tangible and more influential than simply a 'moral panic', suggesting that digital diversity in the workforce has roots in real evidence and it is not simply an issue of public concern (e.g., "*Having them [natives] has brought new expectations about how the final*

*software should look like. We have approached more creative and intuitive solutions,"*" "*I'm a socialish [with an ironic tone] person but I am not used to be that social when it comes to collaborating on code," "Their [digital natives'] work attitudes bring expectations of working for longer hours").*

Addressing the second question, the findings revealed seven promise items consisted of three promise categories (organizational learning, innovation, productivity), and, eleven challenges categorized into three broad areas (conceptual challenges, organizational challenges, process challenges). In identifying and clarifying the promise and challenge of digital diversity in software development workforce (Table 2), this study makes an important contribution to the existing literature in the form of generalizing from description (empirical data, involving multiple sources of evidence and member checking) and theory to theory (Lee and Baskerville 2003).

The theme emerging from the empirical data indicates that digital diversity, with its certain promise and recognized challenges that can be bridged to some extent has important implications for digital immigrants that should be taken into account. For example, software development is reported as a particularly dynamic environment, which increasingly appreciates the skills, attitudes, and characteristics of new developers who are extremely and inherently aligned with new tools, technologies, and methods of developing software. Matloff (Matloff 2012) quotes from Craig Barrett, the former chief executive officer of Intel, "*the half-life of an engineer, software or hardware, is only a few years*", besides making a note from Mark Zuckerberg of Facebook that "*young programmers are superior*" .While increasing age-based conclusions (which are now also intertwined with the concept of digital nativeness), having roots in quotes from famous IT celebrities, have been questioned by industry reports (McAllister 2012), practice prompts research to refine our understanding of the professional activities that attract the older generation of developers (e.g., joining other non-software development industries, management roles, consulting, or establishing start-ups). Taken these observations into account, this study is hoped to inspire and encourage future research to focus longitudinal efforts on identifying the specific implications of the rise of digital natives in software development for the career path of digital immigrants, and, on refining our knowledge on validating tactics for addressing the increasing digital diversity in the software development workforce.

Software companies may get a sense of these findings to suggest where managerial efforts and resources can be directed to leverage the promise of digital diversity and to address its potential challenges. For example, the following strategies may be devised to bridge different perceptions and opinions: (i) appreciating and sharing within-the-company success stories that highlight how the combination of digital natives and immigrants, along with their different approaches and attitudes, can enable organizational learning, innovation, and productivity, and in turn development of better software, (ii) training and encouragement of employees to arrive at shared understanding; for example, training digital natives to challenge their understanding and get themselves familiar with the fundamental components of programming would help address '*Natives' limited understanding of the core concepts of computer science*' as well as designing reward systems that require digital immigrants to provide quick feedback and appreciation supports tackling '*Natives' overemphasis on instant feedback and gratification*.'

**Developing a model surrounding the impact of digital diversity on work-related outcomes.** The starting point for the current study was (i) the inconsistency in the various findings regarding the rise digital natives, and (ii) scarcity of research on the increasing rise of digital natives in the workforce. In addition to integrating existing theory (*e.g.,* (Bennett et al. 2008; Van Knippenberg et al. 2004; Vodanovich et al. 2010)) and empirical data in such a way that some of the characteristics of digital diversity and the promise and challenge of diversity (Table 2) were recognized (addressing research questions), this study advances our understanding of how digital diversity may affect work-related outcomes in the particular setting of software development (Figure 1). More specifically, the empirical statements partially support categorization-elaboration framework. For example, results emphasize that the potential benefits of digital diversity can be realized and harvested by focusing on fostering elaboration (as suggested by the categorization-elaboration framework). However, the overall results, regarding social categorizations, mostly concurred with Joshi et al. (Joshi et al. 2010)'s recognition of software development as strong organic contexts where categorization-based responses between succeeding and preceding generations are less likely (because generations in these contexts tend to have complementary knowledge, and collaboration among them help accomplish tasks). Analysis of data, however, recognized tangible organizational challenges besides different approaches and expectations

that may arise from digital diversity between natives and immigrants, which are not covered in the existing categorization-based models of diversity. The model also argues the moderating impact of task requirements, task motivation, and task ability of individuals. Specifically, the digital diversity can have more positive consequences when the task requires and benefits from information processing, creative and innovative idea generation and problem solving, and the negative consequences of digital diversity (challenge) can be more when the task does not require such characteristics. For example, the blend of digital natives and immigrants is in particular useful for development activities, such as requirement specification, that require strong information-processing and decision-making requirements (Chakraborty et al. 2010; Mathiassen et al. 2007). In addition, empirical data suggested that digital diversity can have more positive consequences when team is consisted of motivated and capable members in information sharing, and also more negative consequences when team members are less motivated and capable in sharing task-related information. Motivation for sharing task-relevant information may be encouraged by leadership that treats both generations with fairness and respect and sets challenging goals for boosting innovation (Van Knippenberg et al. 2004). Regarding task ability, diverse development teams may benefit from selecting individuals high in communication and cognitive skills, and if all team members are not high in these skills, team members can be, at least, selected in a way that they reach more extended tenure so that they have developed transactive memory and become familiar with each others' perspectives over time.

Inspired by invaluable research calls (Vodanovich et al. 2010), it is recommended that IS researchers follow the less travelled path of 'research on digital natives in workforce' to yield greater insights into exploring the dynamic nature of digital diversity and the several important implications of this phenomenon for companies, employees, and other stakeholders in IS-related contexts.

## Conclusions

This study recognized certain definitional and contextual limitations with regard to research on the rise of digital natives. As the current trend of research, with some existing limitations, has relatively matured, researchers have started questioning inherit differences between natives and immigrants. This study was designed and conducted with appreciating the need to carefully examine the rise of digital natives in the contemporary workforce, in the particular context of software development. In light of existing theories on work-group diversity and informed by empirical data collected from a multisite investigation, this study takes new steps in investigating the paradoxical concept of digital diversity in tech-savvy work environments such as software development companies, articulating the key promise and challenge of digital diversity in software development workforce, and elaborating some core underlying mechanism through which digital diversity may trigger work-related outcomes.

It is hoped that the combination of these efforts will inspire future IS research and will yield realistic advice concerning how to manage effective software development performance in an increasingly diverse workforce.

## References

Aggarwal, I., and Woolley, A.W. 2013. "Do You See What I See? The Effect of Members' Cognitive Styles on Team Processes and Errors in Task Execution," *Organizational Behavior and Human Decision Processes* (122:1), pp. 92-99.

Alsop, R. 2008. *The Trophy Kids Grow Up: How the Millennial Generation Is Shaking up the Workplace*. San Francisco, CA: Jossey-Bass, Wiley.

Barlow, J.P. 1996. "Decraration of Independence for Cyberspace " Retrieved 20 March, 2014, from https://homes.eff.org/~barlow/

Bennett, S., Maton, K., and Kervin, L. 2008. "The 'Digital Natives' Debate: A Critical Review of the Evidence," *British journal of educational technology* (39:5), pp. 775-786.

Biggs, S. 2007. "Thinking About Generations: Conceptual Positions and Policy Implications," *Journal of Social Issues* (63:4), pp. 695-711.

Burnett, J. 2010. *Generations: The Time Machine in Theory and Practice*. Surrey, Burlington: Ashgate Publishing Company.

Chakraborty, S., Sarker, S., and Sarker, S. 2010. "An Exploration into the Process of Requirements Elicitation: A Grounded Approach," *Journal of the Association for Information Systems* (11:4).
Cunningham, G.B. 2011. "The Lgbt Advantage: Examining the Relationship among Sexual Orientation Diversity, Diversity Strategy, and Performance," *Sport Management Review* (14:4), pp. 453-461.
D'Amato, A., and Herzfeldt, R. 2008. "Learning Orientation, Organizational Commitment and Talent Retention across Generations: A Study of European Managers," *Journal of Managerial Psychology* (23:8), pp. 929-953.
Dawande, M., Johar, M., Kumar, S., and Mookerjee, V.S. 2008. "A Comparison of Pair Versus Solo Programming under Different Objectives: An Analytical Approach," *Information Systems Research* (19:1), pp. 71-92.
Egri, C., and Ralston, D. 2004. "Generation Cohorts and Personal Values: A Comparison of China and the United States," *Organization science* (15:2), pp. 210-220.
Fitzgerald, B. 2012. "Software Crisis 2.0," *Computer* (45:4), pp. 89-91.
Fitzgerald, B., and Stol, K.-J. 2014. "Continuous Software Engineering and Beyond: Trends and Challenges," "*in Proceedings of the* "*RCoSE*, Heydarabad, India.
Flick, U. 2014. *An Introduction to Qualitative Research*. London, Uk: Sage.
Ghobadi, S., and D'Ambra, J. 2013. "Modeling High-Quality Knowledge Sharing in Cross-Functional Software Development Teams " *Information Processing & Management* (49:1), pp. 138-157.
Gilleard, C., and Higgs, P. 2005. *Contexts of Ageing: Class, Cohort and Community*. Cambridge, UK: Polity Press.
Gonzalez, J.A. 2012. "Relational Demography between Managers and Stakeholders and Business Unit Performance," *Journal of Leadership & Organizational Studies* (19:4), pp. 450-461.
Gui, M., and Argentin, G. 2011. "Digital Skills of Internet Natives: Different Forms of Digital Literacy in a Random Sample of Northern Italian High School Students," *New media & society* (13:6), pp. 963-980.
Guo, R.X., Dobson, T., and Petrina, S. 2008. "Digital Natives, Digital Immigrants: An Analysis of Age and Ict Competency in Teacher Education," *Journal of educational computing research* (38:3), pp. 235-254.
Hansen, J.-I.C., and Leuty, M.E. 2012. "Work Values across Generations," *Journal of Career Assessment* (20:1), pp. 34-52.
Harvey, J.-F. 2012. "Managing Organizational Memory with Intergenerational Knowledge Transfer," *Journal of Knowledge Management* (16:3), pp. 400-417.
Hayles, N.K. 2007. "Hyper and Deep Attention: The Generational Divide in Cognitive Modes," *Profession*), pp. 187-199.
Helsper, E.J., and Eynon, R. 2010. "Digital Natives: Where Is the Evidence?," *British educational research journal* (36:3), pp. 503-520.
Hendricks, J.M., and Cope, V.C. 2012. "Generational Diversity: What Nurse Managers Need to Know," *Journal of Advanced Nursing* (69:3), pp. 717–725.
Hoffman, L.R. 1959. "Homogeneity of Member Personality and Its Effect on Group Problem-Solving," *The Journal of Abnormal and Social Psychology* (58:1), p. 27.
Holsti, O.R. 1969. *Content Analysis for the Social Sciences and Humanities*. Don Mills, ON: Addison-Wesley.
Jones, C., Ramanau, R., Cross, S., and Healing, G. 2010. "Net Generation or Digital Natives: Is There a Distinct New Generation Entering University?," *Computers & education* (54:3), pp. 722-732.
Joshi, A., Dencker, J.C., and Franz, G. 2011a. "Generations in Organizations," *Research in Organizational Behavior* (31:1), pp. 177-205.
Joshi, A., Dencker, J.C., and Franz, G. 2011b. "Generations in Organizations," *Research in Organizational Behavior* (31), pp. 177-205.
Joshi, A., Dencker, J.C., Franz, G., and Martocchio, J.J. 2010. "Unpacking Generational Identities in Organizations," *Academy of Management Review* (35:3), pp. 392-414.
Kang, H.-R., Yang, H.-D., and Rowley, C. 2006. "Factors in Team Effectiveness: Cognitive and Demographic Similarities of Software Development Team Members," *Human Relations* (59:12), pp. 1681-1710.
Kearney, E., and Gebert, D. 2009. "Managing Diversity and Enhancing Team Outcomes: The Promise of Transformational Leadership," *Journal of Applied Social Psychology* (94:1), pp. 77-89.
Kelan, E. 2009. "The Reflexive Generation: Young Professionals' Perspectives on Work, Career and Gender," London School of Business.
Kozhevnikov, M. 2007. "Cognitive Styles in the Context of Modern Psychology: Toward an Integrated Framework of Cognitive Style," *Psychological bulletin* (133:3), p. 464.
Krill, P. 2011. "Oracle Looks to Keep Java Interesting and Attract Young Developers " in: *InfoWorld*. Boston, Massachusetts: IDG.

Laukkanen, M. 1994. "Comparative Cause Mapping of Organizational Cognitions," *Organization Science* (5:3), pp. 322-343.
Lawrence, B.S., and Zyphur, M.J. 2011. "Identifying Organizational Faultlines with Latent Class Cluster Analysis," *Organizational Research Methods* (14:1), pp. 32-57.
Lee, A.S., and Baskerville, R.L. 2003. "Generalizing Generalizability in Information Systems Research," *Information Systems Research* (14:3), pp. 221-243.
Lester, S.W., Standifer, R.L., Schultz, N.J., and Windsor, J.M. 2012. "Actual Versus Perceived Generational Differences at Work an Empirical Examination," *Journal of Leadership & Organizational Studies* (19:3), pp. 341-354.
Leung, L. 2013. "Generational Differences in Content Generation in Social Media: The Roles of the Gratifications Sought and of Narcissism," *Computers in Human Behavior* (29:3), pp. 997-1006.
Livingstone, S. 2010. "Digital Learning and Participation among Youth: Critical Reflections on Future Research Priorities," *International Journal of Learning* (2:2-3), pp. 1-13.
Mannheim, K. 1952. "The Problem of Generations," in *Essays on the Sociology of Knowledge,* K. Mannheim (ed.). London, UK: Routledge, pp. 276–322.
Mannix, E., and Neale, M.A. 2005. "What Differences Make a Difference? The Promise and Reality of Diverse Teams in Organizations," *Psychological Science in the Public Interest* (6:2), pp. 31-55.
Marcinkus Murphy, W. 2012. "Reverse Mentoring at Work: Fostering Cross-Generational Learning and Developing Millennial Leaders," *Human Resource Management* (51:4), pp. 549-573.
Margaryan, A., Littlejohn, A., and Vojt, G. 2011. "Are Digital Natives a Myth or Reality? University Students' Use of Digital Technologies," *Computers & education* (56:2), pp. 429-440.
Mathiassen, L., Saarinen, T., Tuunanen, T., and Rossi, M. 2007. "A Contigency Model for Requirements Development," *Journal of the Association for Information Systems* (8:11), pp. 569-597.
Matloff, N. 2012. "Software Engineers Will Work One Day for English Majors," in: *BloombergView*.
McAllister, N. 2012. "Where Do All the Old Programmers Go?," in: *InforWorld*. Boston, Massachusetts: IDG.
Mitchell, R.J., Parker, V., and Giles, M. 2011. "When Do Interprofessional Teams Succeed? Investigating the Moderating Roles of Team and Professional Identity in Interprofessional Effectiveness," *Human Relations* (64:10), pp. 1321-1343.
Nelson, K.M., Nadkarni, S., Narayanan, V., and Ghods, M. 2000. "Understanding Software Operations Support Expertise: A Revealed Causal Mapping Approach," *MIS Quarterly* (24:3), pp. 475-507.
Ng, W. 2012. "Can We Teach Digital Natives Digital Literacy?," *Computers & education* (59:3), pp. 1065-1078.
Oshri, I., van Fenema, P., and Kotlarsky, J. 2008. "Knowledge Transfer in Globally Distributed Teams: The Role of Transactive Memory," *Information Systems Journal* (18:6), pp. 593-616.
Patton, M.Q. 1990. *Qualitative Evaluation and Research Methods*. Thousand Oaks, CA: SAGE Publications.
Prensky, M. 2001. "Digital Natives, Digital Immigrants," *On the Horizon* (9:5), pp. 1-15.
Prensky, M. 2009. "H. Sapiens Digital: From Digital Immigrants and Digital Natives to Digital Wisdom," *Journal of Online Education* (5:3), pp. 1-9.
Puybaraud, M., and Hannah, H. 2012. "Digital Natives: A Tech-Savvy Generation Enters the Workplace," in: *Work Design*. NY, USA: WorkDesign co.
Qureshi, S. 2006. "Adaptation in Distributed Projects: Collaborative Processes in Digital Natives and Digital Immigrants," "*in Proceedings of the "39th Hawaii International Conference on System Sciences (HICSS),* R. Sprague (ed.), Hyatt Regency Kauai, Hawaii: IEEE, pp. 1-10.
Redford, D.B. 2003. *The Oxford Essential Guide to Egyptian Mythology*. Oxford: Oxford University Press.
Rescher, N. 1987. "Life's Seasons: The Conceptual Phenomenology of Age-Periodization," in *Forbidden Knowledge*. Springer, pp. 100-112.
Rice, R.E., and Katz, J.E. 2003. "Comparing Internet and Mobile Phone Usage: Digital Divides of Usage, Adoption, and Dropouts," *Telecommunications Policy* (27:8), pp. 597-623.
Roberson, Q.M. 2012. *The Oxford Handbook of Diversity and Work*. UK: Oxford University Press.
Rogers, E.M. 2001. "The Digital Divide," *Convergence: The International Journal of Research into New Media Technologies* (7:4), pp. 96-111.
Sarker, S., and Sarker, S. 2009. "Exploring Agility in Distributed Information Systems Development Teams: An Interpretive Study in an Offshoring Context," *Information Systems Research* (20:3), pp. 440-461.
Scott, W.A. 1955. "Reliability of Content Analysis: The Case of Nominal Scale Coding," *Public opinion quarterly* (19:1), pp. 321-325.

Seong, J.Y., Kristof-Brown, A.L., Park, W.-W., Hong, D.-S., and Shin, Y. 2012. "Person-Group Fit Diversity Antecedents, Proximal Outcomes, and Performance at the Group Level," *Journal of Management* (94:3), pp. 814-828.
Sharp, J. 2000. "Digital Diversions: Youth Culture in the Age of Multimedia," *Gender Ed* (12:1), pp. 138-139.
Shewchuk, R.M., Sherrill, W.W., and Mba, M.H.A. 2009. "Managing a Diverse Health Services Workforce," in *Strategic Human Resources Management in Health Services Organizations,* R.S. Hernandez and S.J. O'Connor (eds.). Clifton Park, NY: Delmar, College Learning, pp. 117-133.
Small, G.W., and Vorgan, G. 2009. *Ibrain*. New York: Collins Living.
Smola, K., and Sutton, C. 2002. "Generational Differences: Revisiting Generational Work Values for the New Millennium," *Journal of organizational behavior* (23:4), pp. 363-382.
Srinivasan, V. 2012. "Multi Generations in the Workforce: Building Collaboration," *IIMB Management Review* (24:1), pp. 48-66.
Storm, D. 2011. "Gen Y Demands Greater Work Flexibility, Says Cisco Study," Cisco San Jose, USA.
Tilvawala, K., Sundaram, D., and Myers, M. 2013. "Design of Organisational Ubiquitous Information Systems: Digital Native and Digital Immigrant Perspectives," "*in Proceedings of the* "*Pacific Asia Conference on Information Systems (PACIS),* H.G. Lee and P.Y.K. Chau (eds.), Jeju Island, Korea: AIS, p. 171.
Twenge, J.M. 2010. "A Review of the Empirical Evidence on Generational Differences in Work Attitudes," *Journal of Business and Psychology* (25:2), pp. 201-210.
Twenge, J.M., Campbell, S.M., Hoffman, B.J., and Lance, C.E. 2010. "Generational Differences in Work Values: Leisure and Extrinsic Values Increasing, Social and Intrinsic Values Decreasing," *Journal of Management* (36:5), pp. 1117-1142.
Van Dijk, J., and Hacker, K. 2003. "The Digital Divide as a Complex and Dynamic Phenomenon," *The Information Society* (19:4), pp. 315-326.
Van Dijk, J.A.G.M. 2006. "Digital Divide Research, Achievements and Shortcomings," *Poetics* (34:4), pp. 221-235.
Van Knippenberg, D., De Dreu, C.K., and Homan, A.C. 2004. "Work Group Diversity and Group Performance: An Integrative Model and Research Agenda," *Journal of applied psychology* (89:6), pp. 1008-1022.
van Knippenberg, D., and van Ginkel, W.P. 2010a. "The Categorization-Elaboration Model of Work Group Diversity: Wielding the Double-Edged Sword," in *The Psychology of Social and Cultural Diversity. Social Issues and Interventions,* W.P. van Ginkel and R.J. Crisp (eds.). Wiley-Blackwell, pp. 257-280.
van Knippenberg, D., and van Ginkel, W.P. 2010b. "The Categorization-Elaboration Model of Work Group Diversity: Wielding the Double-Edged Sword," in *The Psychology of Social and Cultural Diversity,* W.P. van Ginkel and R.J. Crisp (eds.). Sussex, United Kingdom: Willey Online Library, pp. 257-280.
Vessey, I., and Conger, S.A. 1994. "Requirements Specification: Learning Object, Process, and Data Methodologies," *Communications of the ACM* (37:5), pp. 102-113.
Vodanovich, S., Sundaram, D., and Myers, M. 2010. "Research Commentary—Digital Natives and Ubiquitous Information Systems," *Information Systems Research* (21:4), pp. 711-723.
Walsham, G. 1995. " Interpretive Case Studies in Is Research: Nature and Method," *European Journal Of Information Systems* (4:2), pp. 74-81.
Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., and Gray, K. 2010. "Digital Divides? Student and Staff Perceptions of Information and Communication Technologies," *Computers & education* (54:4), pp. 1202-1211.
Wei, K.K., Teo, H.H., Chan, H.C., and Tan, B.C.Y. 2011. "Conceptualizing and Testing a Social Cognitive Model of the Digital Divide," *Information Systems Research* (22:1), pp. 170-187.
Yang, Y., and Konrad, A.M. 2011. "Diversity and Organizational Innovation: The Role of Employee Involvement," *Journal of Organizational Behavior* (32:8), pp. 1062-1083.
Yu, K.Y.T., and Cable, D.M. 2011. "Unpacking Cooperation in Diverse Teams: Incorporating Long-Term Orientation and Civic Virtue in the Study of Informational Diversity," *Team Performance Management* (17:1/2), pp. 63-82.
Zweben, S. 2011. "Computing Degree and Enrollment Trends," Computing Research Association, Washington, DC.